

SAMPLING AND ANALYSIS PLAN

for

UNIFIED DISPOSAL DISTRICT
HAVRE, MONTANA



DAMSCHEN & ASSOCIATES, INC.

CONSULTING ENGINEERS

• HELENA, MONTANA •



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SAMPLING AND ANALYSIS PLAN

for

UNIFIED DISPOSAL DISTRICT HAVRE, MONTANA

RECEIVED

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MONTANA DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
BUREAU

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PREPARED BY

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July, 1993

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I. FIELD SAMPLING PLAN

A. Introduction

This document is the Sampling and Analysis Plan for ground water monitoring at the landfill licensed to the Unified Disposal District facility east of Havre, Montana, license #222. The procedures detailed herein outline the requirements of the State of Montana Department of Health and Environmental Sciences Bureau of Solid and Hazardous Waste regulations with regard to sampling frequency, sampling procedures, quality assurance and quality control.

A.1. Location and Description. The landfill site is located approximately 11 miles east-southeast of Havre, Montana, in Section 1 of Township 32 North, Range 17 East and Section 6 of Township 32 North, Range 18 East (Figure 1). It is accessible by paved road via U.S. highway 2.

The waste fill area currently occupies the head of a small gulch on the southern side of the Milk River (Figures 1 and 2). The waste fill area shown on Figure 2 was mapped in 1989, but the areal extent of the fill has changed very little since then.

A.2. Site History. The Unified Disposal District landfill was initially sited in 1983. Two wells were drilled at the site at that time, one as a supply well for the shop and the other as an "observation" well (Damschen & Associates, Inc., 1991). Two ground water monitoring wells were completed in 1989 (Damschen & Associates, 1991). In the spring of 1993 five additional ground water monitoring wells were completed along with four piezometers and numerous test borings in an attempt to characterize the hydrogeology (Figure 2).

The hydrogeology at the site is complex; at least five separate aquifers have been delineated and others probably exist. The uppermost aquifer on the southern side of the landfill lies in glacially-derived gravel and sand 17 to 20 feet thick that now exists as a wedge of sediments that lies between the fill area and a deep drainage ditch that was installed in 1992 to alleviate run-on. This aquifer is penetrated by a single monitoring well, MW-7 (Appendix A). The recharge and discharge for this relatively small aquifer have yet to be clearly determined.

Beneath the gravel-hosted aquifer on the southern side of the facility is a water-bearing zone hosted by sand within the Judith River formation. This aquifer is penetrated by MW-3 at a depth of 55 to 60 feet below the ground surface (Appendix A).

Elsewhere, the uppermost aquifer lies between 30 and 105 feet of the ground surface (Appendix A). In all instances, the wells apparently intercept different aquifers.

Additional aquifers lie at depth within sand and coal beds belonging to the Cretaceous-aged Judith River formation. All of these aquifers exhibit very small production potential, generally less than one gallon per minute. All of the aquifers are confined to one degree or another and appear to be discontinuous. It is presumed that the presence of water in these

sand aquifers is controlled by the environment of deposition of the Judith River formation; these are terrestrial sediments deposited in a fluvially-dominated delta or coastal plain environment. Thus, the sand beds represent channel deposits or bar deposits, which tend to be linear or sinuous, and which are laterally discontinuous.

The recharge area for the gravel aquifer has previous been shown to be south of the facility. On those occasions when enough recharge is available, the aquifer discharges to the drainage ditch along the southern edge of the fill area. The recharge and discharge zones for the deeper aquifers have not as yet been clearly delineated.

B. Objectives

The purpose of this document is to provide procedural guidelines for the routine detection monitoring. Included herein are procedures for sample vessel preparation, ground water sampling, sample storage, quality assurance and quality control.

C. Sampling Frequency

Water samples from each well shall be obtained by qualified personnel on a semi-annual basis. The samples shall be analyzed for the set of parameters listed in Table 1, ARM 16.14.706(4), by a qualified analytical laboratory.

Notification of the sampling event shall be given to the Montana State Department of Health and Environmental Sciences fourteen days prior to the anticipated sampling event. This notification provides them with the opportunity to obtain splits or duplicates of the samples in the field.

D. Access

The landfill is accessible for sampling between 8:00 AM and 5:00 PM Monday through Friday. The landfill also operates Saturdays and Sundays from 10:00 AM to 4:00 PM during the spring and summer. Arrangements for access to keys for the landfill and monitoring well locks will have to be made with the director of the Unified Disposal District facility at (206) 265-5481 or with the landfill foreman at (206) 265-9404.

All of the wells are accessible by dirt road on the facility.

E. Sampling Procedures

E.1. Sample Acquisition Methods/Field QA/QC. All wells shall be sounded for static water level and total depth with a standard water-measuring device according to technically accepted procedures prior to sampling. The manufacturer's name and instrument model number shall be indicated on the sampling event form attached to this document. Wells at the landfill are equipped with dedicated inertial pumps and volatile organic constituents (VOC) sampling tubes manufactured by Waterra Pumps, Ltd, 77 Mowat Avenue, Suite 101, Toronto, Ontario, Canada, telephone (716) 835-3921. The foot valves are located within the screened interval of each well. These pumps are operated by simply pulling four or five feet of the HDPE tubing out of the well and rapidly pumping the tubing up and down until well water is expelled. The well shall be purged of three volumes of the filled casing. In two-inch diameter wells the volume of water in the well is calculated by subtracting the depth to the static water level from the total well depth and multiplying the result by 0.16. The volume of water in a four-inch-diameter casing is calculated by subtracting the depth the water level from the total well depth and multiplying the results by 0.653. These products are the volume of the water in the well in gallons. The purge water shall be measured by pumping into a vessel of known volume, such as a five-gallon bucket.

In case of failure of the pump, the pump foot valve will be inspected and, if necessary, replaced with a new, sterilized foot valve. If the foot valve needs to be replaced, the HDPE tubing shall be removed and rolled into a large plastic bag to avoid contamination.

Field measurements of temperature, conductivity and pH shall be obtained immediately prior to sample collection and again immediately after sample collection. Another measurement shall also be taken during the sampling procedure, if possible. The measurements shall be taken with a reliable instrument that has been calibrated with fresh buffer solutions prior to the sampling event, according to instrument manufacturer's specifications. The manufacturer's name, the instrument model number and the pertinent information regarding calibration shall be included with the field data sheets for the first sampling event following the approval of this document, and for every sampling event thereafter for which the instrumentation changes.

Samples for all analytes may be taken by directly pumping from the half-inch-diameter polyethylene tubing except for VOC. The VOC should be taken by using the VOC sampling tube, which is an HDPE tube of smaller diameter inserted into the half-inch-diameter tube. The sample should be siphoned from the water trapped in the upper part of the larger-diameter tube, taking care to avoid aeration. This will mitigate the loss of volatile constituents.

Samples must be administered with the appropriate preservatives for the given analyte (Table 1). Since there is disagreement in the industry regarding the use of various preservatives, and since this matter is in constant flux, a list of analytes, EPA analytical methodology, recommended preservatives, and holding times shall be submitted with the documentation

from each sampling event if any of these items deviate from the items listed in Table 1 of this document. Preservatives should be supplied by the analytical laboratory or made with reagent-grade chemicals in accordance with standard laboratory procedures.

If low static water levels or failure of the tubing or foot valve preclude the use of inertial pumps, disposable bailers shall be employed to purge and sample each well. The bailers shall be constructed of polyethylene and will be equipped with disposable VOC sampling tubes. The bailers must be pre-sterilized in order to avoid field decontamination. One bailer shall be used for each well.

Samples acquired for total dissolved metals must be filtered prior to analysis. A new, pre-sterilized in-line filters shall be used for each well. Filters are available from Waterra Pumps, Ltd., or any of several environmental or ground-water materials supply houses. If samples must be taken with a bailer, the sample shall be filtered using a Norton Posi-filter pressurized bailer, but must not be acidified until after the sample is filtered. Information regarding the type and manufacturer of procedures and the instrumentation used must be included with the field data sheets.

E.2. Locations and Identification of Wells. Each well is uniquely labeled and located on Figure 2.

E.3. Sampling Order. The wells should be sampled in the following order: MW-3, MW-4, MW-6, MW-7, MW-5.

The aquifer intercepted by monitoring wells MW-1 and MW-2 are currently considered unlikely targets for monitoring due to the depth of the aquifer(s), which is 220 feet below the landfill base at MW-1 and 160 feet at MW-2. The presence of other perched aquifers and potential migration pathways that lie between this deeper aquifer and the bottom of the landfill appear to be more likely recipients of leachate than the deeper aquifer(s). Therefore, monitoring wells MW-1 and MW-2 are not to be sampled at this time.

E.4. Sampling Objectives. These samples are being taken as part of the routine monitoring program. If results of the analyses reveal the presence of anomalous levels of any contaminants, and re-sampling supports the initial results, the objectives of this Sampling and Analysis Plan will be reviewed.

F. QA/QC Samples

Quality assurance and control shall be achieved through the use of duplicate field samples as well as through blanks and spiked samples to be supplied by the analytical laboratory. Duplicate samples shall be taken during each sampling event. The choice of wells to be used for sample duplication is random. Duplicate samples shall be prepared, stored and shipped in the same manner as all other samples acquired during the sampling event. The duplicate

sample containers must be clearly marked with a unique number and identified as a duplicate on the field data sheets.

G. Shipping and Handling Arrangements

The samples shall be kept on ice or under refrigeration at 4° C until shipment. Samples will be shipped to an analytical laboratory as soon as possible by the most expeditious means available.

H. Notification Procedures

The Solid and Hazardous Waste Bureau shall be notified no less than two weeks prior to each sampling event in order that the Bureau may obtain sample splits.

I. Analytical Parameters

The analytes that must be reported to the State of Montana are listed in Table 1. This list is derived from the Administrative Rules of Montana, Title 16, Chapter 14, Sub-chapter 7, Table 1.

J. Reporting

The owner/operator is responsible for reporting any data gathered at the site to the Montana Solid and Hazardous Waste Bureau within 90 days of receipt of such data, in accordance with ARM 16.14.706(10). All field data sheets and information regarding any changes in instrumentation used at the site shall be submitted at that time. An annual report is also required for the facility.

Table 1. List of analytes from ARM 16.14.706 Table 1 and their holding times, recommended preservatives and recommended EPA analytical procedures.

Analyte	EPA Method	Sampling requirements	Holding Time (days)
Ammonia as N	350.1	1	28
Bicarbonate	310.1	2	14
Calcium	200.7	2	6 months
Carbonate	310.1	2	14
Chloride	300.0	2	28
Iron	200.7	3	6 months
Magnesium	200.7	2	6 months
Manganese	200.7	3	6 months
Nitrate as N	353.2	1	28
Potassium	200.7	2	6 months
Sodium	200.7	2	6 months
Sulfate	300.0	2	28
Chemical Oxygen Demand	410.1	1	28
Total Dissolved Solids @ 180° C	160.1	2	7
Total Suspended Solids	160.2	2	7
Specific Conductance @ 25° C	120.1	2	28
pH	150.1	2	Field
Arsenic	206.2	3	6 months
Barium	200.7	3	6 months
Cadmium	200.7	3	6 months
Chromium	200.7	3	6 months
Cyanide	335.3	4	14
Lead	239.2/200.7	3	6 months
Mercury	245.2	3	28
Selenium	270.3	3	6 months
Silver	200.7	3	6 months
VOCs	8260	5	14

- 1) 250 ml plastic bottle, unfiltered, preserved with H₂SO₄, cool
- 2) 500 ml plastic bottle, unfiltered, unpreserved, cool
- 3) 250 ml plastic bottle, filtered, preserved with HNO₃
- 4) 250 ml plastic bottle, unfiltered, preserved with NaOH, cool
- 5) 2 - 40 ml glass VOA Vials, no headspace, preserved with HCl to pH 2, cool

II. QUALITY ASSURANCE/QUALITY CONTROL

A. Field Quality Assurance/Quality Control

A.1. Standard Operating Procedures. Field quality assurance/quality control (QA/QC) will be maintained through the use of duplicate samples. These standard operating procedures are described in section I.D.1, above, and again in the field procedure summary in Appendix B of this document.

A.2. Documentation. Field procedures shall be documented by completion of the attached field data sheet by field personnel.

A.3. Duplicate samples. At least one duplicate sample shall be collected and submitted for analysis annually. A duplicate sample shall be obtained from any well that has been sampled during a given event. The duplicate should be prepared, labeled, held and analyzed with the rest of the samples obtained during the sampling event. The choice of wells to use for duplicate samples is arbitrary, but the information must be recorded and included in the data submissions and annual report.

A.4. Field Instrument Calibration. Field instruments shall be calibrated immediately prior to the sampling event, between samples, if feasible, and immediately after the sampling event. Calibration shall be completed according to the specifications supplied by the manufacturer for the instrument used. The calibration information shall be attached to the field data sheets if the instrument has not been used at this site prior to the date of the sampling event.

A.5. Chain of Custody Procedures. Custody of samples shall be recorded on forms submitted to the sampler by the analytical laboratory. The sampler shall sign and retain a copy of the chain of custody form when samples are relinquished to the laboratory. The laboratory shall maintain copies of the chain of custody form and provide the sampler and client with copies upon request.

B. Laboratory QA/QC

Neither the sampler nor the client can dictate laboratory QA/QC procedures. The laboratory chosen by the sampler or client is responsible for their own QA/QC, with the understanding that basic requirements exist. Turnaround time, laboratory blanks or spiked samples, instrument calibration, data reduction, data validation, quality control, and specific procedures for routine assessment of data precision, accuracy and completeness will be assessed during evaluation of analytical results. Any problems or deviations from standard laboratory reporting procedures shall be reported to the Bureau in the annual report and result in the reconsideration of the laboratory being used.

III. HEALTH AND SAFETY PLAN

At the time of this writing, there is no evidence of ground-water contamination at the Unified Disposal District landfill that could be considered significantly toxic to humans. This situation shall be reassessed with each sampling event and the SAP revised to reflect any changes in ground-water quality that could impact the sampler.

A. Level of Protection

At the time of this writing there is no evidence that contamination at the site, if present at all, would require a level of protection greater than Level D, as described in 29 CFR 1910.120. This includes, for monitoring well sampling, eye protection and disposable latex gloves.

B. Hazard Evaluation

If volatile components are detected in any well and hazard evaluation equipment (e.g. LEL meter, hydrocarbon detector) is unavailable, sampling is to cease immediately. A return visit with appropriate equipment will be required to better characterize the hazard. If potentially dangerous constituents are discovered through chemical analysis, the sampling objectives, along with the Health and Safety Plan, shall be re-evaluated.

C. Ground-Water Characteristics

The nature of the ground-water chemistry may be found in an unpublished report from Stiller and Associates to Damschen & Associates, dated December 9, 1985, as well as in the annual reports submitted to the Montana Department of Health and Environmental Sciences Solid and Hazardous Waste Bureau (SHWB). The Stiller and Associates report is on file with the SHWB, Damschen & Associates, Inc. of Helena, Montana, and with the Madison County Sanitarian at the Courthouse in Virginia City, Montana.

D. Special Site Considerations

No special considerations are expected for the Twin Bridges landfill with regard to general health and safety.

E. Emergency Information

The nearest medical facility is the Northern Montana Hospital, 30 13th Street South, Havre, telephone 265-2211. A telephone is available at the landfill shop at the main entrance.

F. Decontamination Procedures

F.1. Disposal Water. Water that is not bottled for analysis will be disposed of on the site in an area that is not being actively filled with waste. The water shall not be disposed of within a 50-foot radius of any monitoring well.

F.2. Equipment and Personnel Decontamination. Clean water from a municipal supply source should be used with detergent to decontaminate any equipment or skin exposed to ground water that has been clearly shown to carry contamination.

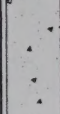
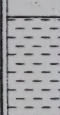
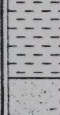
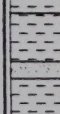
References

- Montana Department of Health and Environmental Sciences, 1991, Groundwater Monitoring: Administrative Rules of Montana, Title 16, Chapter 14, Sub-chapter 7.
- United States Environmental Protection Agency, 1977, Procedures manual for ground water monitoring at solid waste disposal facilities: U.S. Environmental Protection Agency, Office of Solid Waste, 401 M St. SW, Washington, D.C., 269 p.
- United States Environmental Protection Agency, 1983, Interim guidelines and specifications for preparing quality assurance project plans: U.S. Environmental Protection Agency, Office of Monitoring Systems and Quality Assurance, Washington, D.C., 29 p.
- Damschen & Associates, Inc., 1991, Hydrogeologic analysis for the existing sanitary landfill: unpublished hydrogeological report to the Montana Solid and Hazardous Waste Bureau prepared for the Unified Disposal District, Havre, Montana, 43 pages, appendices.

TEST BORING LOG

Project Name UNIFIED DISPOSAL
 Location T32N, R18E, NE SW Sec.6
 Location (N,S) _____ (E,W) _____
 Surface Elevation 2601.32 / COLLAR = 2605.19
 Driller SHARP DRILLING, SIDNEY, MT.
 Hole Dia. 4 3/4"

Project number 93-06
 Well number UDD-9/MW-3
 Date(s) 4/15/93
 Logged By B. SIEGMUND
 Drill Method AIR ROTARY
 Casing (type, depth) 2" PVC, 60'

DEPTH (FEET)	ELEV. (FEET)	GRAPHIC LOG	MATERIALS DESCRIPTION
5	2601		LIGHT BROWN-GRAY SAND
10	259		COARSE SAND AND GRAVEL
20	258		MEDIUM GRAY SILTY CLAY
30	257		VERY FINE GRAINED GRAY SAND
35			LIGHT GRAY SILTY CLAY GRADING TO DARKER GRAY CLAY WITH DEPTH
40	256		VERY FINE GRAINED, GRAY, SILTY SAND
			MAROON, CARBON RICH CLAY
			GRAY SILTY CLAY
45			GRAY FINE GRAINED SAND
			GRAY, SILTY CLAY
50	255		VERY FINE GRAINED SILTY SAND



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TEST BORING LOG

Project Name UNIFIED DISPOSAL

Project number 93-06

Well number UDD-9/MW-3

DEPTH (FEET)	ELEV. (FEET)	GRAPHIC LOG	MATERIALS DESCRIPTION
55			GRAY, FINE GRAINED SILTY SAND LIGHT GRAY LIMY SANDSTONE/SANDY CARBONATE, VERY RESISTANT
60	254		VERY FINE GRAINED, SILTY SAND, MOIST, WATER CAN BE BLOWN FROM HOLE AFTER LESS THAN 10 MINUTES. GRAY SILTY CLAY.
65			TOP 18' DRILLED ON WATER MIXED WITH TWO 50 LB. SACKS OF BENTONITE GEL. 6" STEEL CASING WAS DRIVEN TO 18' TO CASE OFF WATER IN UPPERMOST GRAVEL. DRILLED TO 20' ON AIR. SHUT DOWN COMPRESSOR FOR A SHORT TIME. UPON BLOWING AIR INTO THE HOLE, NO WATER WAS RETURNED. THE REMAINDER OF THE HOLE WAS DRILLED ON AIR. HOLE WAS COMPLETED AS A MONITORING WELL. SEE D-HS COMPLETION FORMS FOR CONSTRUCTION DETAILS.



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TEST BORING LOG

Project Name UNIFIED DISPOSAL
 Location T32N, R18E, SW NW Sec.6
 Location (N,S) _____ (E,W) _____
 Surface Elevation 2608.43/COLLAR-2611.26
 Driller SHARP DRILLING, SIDNEY, MT.
 Hole Dia. 4 3/4"

Project number 93-06
 Well number UDD-13/MW-4
 Date(s) 4/17/93
 Logged By B. SIEGMUND
 Drill Method AIR ROTARY
 Casing (type, depth) 2" PVC, 115

DEPTH (FEET)	ELEV. (FEET)	GRAPHIC LOG	MATERIALS DESCRIPTION
	2608.4		TOPSOIL, SANDY LOAM
5			FINE TO MEDIUM GRAINED BROWN TO TAN SAND WITH STREAKS OF GRAVEL, AS INDICATED, Gg
10	2598.4		LIGHT TO MEDIUM GRAY SILTY CLAY
15			GRAY BROWN CLAY, SLIGHTLY STICKY, POSSIBLY LITHIC INCLUSION IN GLACIAL DRIFT OR GLACIOLACUSTRINE DEPOSIT.
20	2588.4		GRAY FINE GRAINED SAND
25			RESISTANT CARBONATE WITH SILTY SANDSTONE
30	2578.4		BROWNISH TAN CLAY, KIR LIMEY GRAY SANDSTONE
35			BROWNISH-TAN SILTY CLAY
40	2568.4		LIGHT GRAY SILTY CLAY
45			MEDIUM TO FINE GRAINED SAND, GRAY-BROWN AT TOP OF INTERVAL GRADING TO RUSTY TAN AT BOTTOM
50			FINE GRAINED GRAY SILTY SAND, POORLY SORTED.
			LIGHT TO MEDIUM GRAY SILTY CLAY



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TEST BORING LOG

Project Name UNIFIED DISPOSAL

Project number 93-06

Well number UDD-13/MW-4

DEPTH (FEET)	ELEV. (FEET)	GRAPHIC LOG	MATERIALS DESCRIPTION
55	2558.4		MEDIUM TO DARK GRAY SILTY CLAY
			CARBONATE RICH SANDY SILTSTONE
			SILTY GRAY CLAY
			VERY FINE GRAINED SILTY GRAY SAND, MOIST
60	2548.4		SILTY GRAY CLAY
65			LIGHT TO MEDIUM GRAY SILTY CLAY
70	2538.4		COARSE GRAINED SILTY CLAY
75			VERY FINE GRAINED GRAY SAND
80	2528.4		RESISTANT CARBONATE RICH SILTY SANDSTONE
			VERY FINE GRAINED GRAY SAND
85			INTERBEDDED GRAY AND MAROON CLAY
90	2518.4		FINE TO MEDIUM GRAINED GRAY SAND, SLIGHTLY DAMP
			GRAY CLAY
			GRAY SAND AS ABOVE, WITH SEVERAL THIN CARBONATE RICH ZONES.
100	2508.4		GRAY CLAY
			FINE-TO MEDIUM-GRAINED GRAY SAND, SLIGHTLY DAMP
105			ORGANIC RICH MAROON SHALE GRADING TO GRAY CLAY



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TEST BORING LOG

Project Name UNIFIED DISPOSAL

Project number 93-06

Well number UDD-13/MW-4

DEPTH (FEET)	ELEV. (FEET)	GRAPHIC LOG	MATERIALS DESCRIPTION
100			GRAY SILTY CLAY
			MAROON CLAY
110	2498.4		SILTY GRAY CLAY
			VERY FINE GRAINED, SILTY GRAY SAND, MOIST
115			SILTY GRAY CLAY
			COMPLETED AS MONITORING WELL, SEE DHES MONITORING WELL CONSTRUCTION FORMS FOR COMPLETION DETAILS.



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TEST BORING LOG

Project Name UNIFIED DISPOSAL Project number 93-06
 Location T32N. R18E. SW NW Sec.6 Well number UDD-10/MW-5
 Location (N,S) _____ (E,W) _____ Date(s) 4/15/93
 Surface Elevation 2536.77/COLLAR=2539.00 Logged By B. SIEGMUND
 Driller SHARP DRILLING, SIDNEY MT. Drill Method AIR ROTARY
 Hole Dia. 4 3/4" Casing (type, depth) 2" PVC, 30'

DEPTH (FEET)	ELEV. (FEET)	GRAPHIC LOG	MATERIALS DESCRIPTION
5	2536.77		LIGHT TAN SILT
			MAROON-BROWN, ORGANIC RICH CLAY
			SHELL BED
			GRAY-BROWN CLAY
10	2526.77		GRAY-BROWN FINE SAND
15			GRAY-BROWN CLAY INTERBEDDED WITH MAROON-BROWN CLAY,
			GRADES TO IRON STAINED GRAY-BROWN CLAY, SLIGHTLY STICKY,
			IRON STAINS ON PARTINGS.
20	2516.77		DRY, LIGHT GRAY SILTY CLAY
25			MEDIUM GRAY, VERY FINE GRAINED SILTY SAND.
30	2506.77		MOIST SILTY CLAY
			SEE DHES MONITORING WELL CONSTRUCTION FORMS FOR COMPLETION DETAILS



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TEST BORING LOG

Project Name UNIFIED DISPOSAL
 Location T32N, R18E, SE NW Sec.6
 Location (N,S) 180N (E,W) 2920E
 Surface Elevation 2606.69
 Driller SHARP DRILLING, SIDNEY, MT.
 Hole Dia. 4 3/4"

Project number 93-06
 Well number UDD-18/MW-6
 Date(s) 4/18/93
 Logged By B. SIEGMUND
 Drill Method AIR ROTARY
 Casing (type, depth) 2" PVC, 105'

DEPTH (FEET)	ELEV. (FEET)	GRAPHIC LOG	MATERIALS DESCRIPTION
5	2606.7		TOPSOIL, SANDY LOAM
10	2596.7		YELLOWISH-BROWN SILT AND SAND
15			
20	2586.7		BROWN, SILTY CLAY, SLIGHTLY SILTY
25			
30	2576.7		BROWNISH-GRAY SILTY CLAY GRADING TO LIGHT GRAY SILTY CLAY AT ~30'
35			
40	2566.7		SILTY, IRON STAINED SILTY SAND GRADING TO BROWNISH-GRAY SAND, ALL FINE GRAINED AND POORLY SORTED.
45			
50	2556.7		SILTY GRAY CLAY



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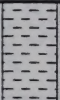
PAGE 1 OF 2

TEST BORING LOG

Project Name UNIFIED DISPOSAL

Project number 93-06

Well number UDD-18/MW-6

DEPTH (FEET)	ELEV. (FEET)	GRAPHIC LOG	MATERIALS DESCRIPTION
55	2556.7		SILTY GRAY CLAY
60	2546.7		
70	2536.7		GRAY-BROWN SILTY, SAND CLAY
75			SILTY GRAY CLAY
80	2526.7		GRAY-BROWN CLAY SILTY GRAY CLAY
85			GRAY SILTY SAND INTERBEDDED WITH CARBON RICH MAROON SAND, FINE GRAINED.
90	2516.7		INTERBEDDED GRAY AND BROWN SILTY CLAY
95			SILTY, FINE GRAINED GRAY SAND
100	2506.7		INTERBEDDED GRAY SAND AND CLAYEY SILT
105			SANDY GRAY CLAY AND FINE GRAY SAND, POOR RETURN, COMPLETED AS MONITORING WELL, SEE DHES CONSTRUCTION FORMS.



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PAGE 2 OF 2

TEST BORING LOG

Project Name UNIFIED DISPOSAL
 Location T32N, R18E, NE SW Sec.6
 Location (N,S) _____ (E,W) _____
 Surface Elevation 2601.5/COLLAR 2605.88
 Driller SHARP DRILLING, SIDNEY, MT.
 Hole Dia. 4 3/4"

Project number 93-06
 Well number UDD-8/MW-7
 Date(s) 4/15/93
 Logged By B. SIEGMUND
 Drill Method AIR ROTARY
 Casing (type, depth) 2" PVC, 16'

DEPTH (FEET)	ELEV. (FEET)	GRAPHIC LOG	MATERIALS DESCRIPTION
5	2601.5		FAIRLY CLEAN, BROWN TO TAN, MEDIUM TO COARSE GRAINED SAND AND MINOR GRAVEL, Og
10	2591.5		SAND AND GRAVEL, PEA TO COBBLE SIZED CLASTS, INJECTED WATER TO KEEP HOLE OPEN.
15			
20	2581.5		MEDIUM GRAY SILTY SHALE SANDY LIMESTONE OR DOLOMITEM, LIGHT GRAY
25			MEDIUM GRAY SILTY SHALE
30	2571.5		FINE GRAINED, SILTY, GRAY SAND
35			MEDIUM GRAY SILTY SHALE
40	2561.5		SANDY, SILTY LIMESTONE OR DOLOMITE, LIGHT GRAY
45			HOLE CAVED AT 16', WHICH PROBABLY REPRESENTS THE TOP OF THE WATER TABLE. A WELL WAS COMPLETED IN THIS HOLE WITH GREAT DIFFICULTY, THERE APPEARS TO BE WATER FROM 16' TO 17'. SEE DHES MONITORING WELL CONSTRUCTION FORM FOR DETAILS.



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PAGE 1 OF 1

Facility/Project Name UNIFIED DISPOSAL DIST. LF		Local Grid Location of Well _____ ft. ☐ N ☐ S ☐ E ☐ W		Well Name MW-3	
Facility License 222		Grid Origin Location Lat. _____ Long. _____ or _____		MT Unique Well Number _____ DHEs Well Name _____	
Type of Well Water Table Observation Well ☐ Piezometer ☐		St. Plane _____ ft. N _____ ft. S		Date Well Installed 04/15/93 m m d d y y	
Distance Well is From Waste/Source Boundary 25 ft.		Section Location of Waste/Source E 1/2 SEC. 6 T 32 N R 18 E ☐ E ☐ W		Well Installed By: (Person's Name and Firm) JOHN SHARP, SHARP DRILLING	
Is Well a Point of Standards Application? ☐ Yes ☐ No		Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known		By: BRUCE SIEGMUND DAMSCHE - ASSOC.	

A. Protective pipe, top elevation **2605.19** ft. MSL

B. Well casing, top elevation **2604.49** ft. MSL

C. Land Surface elevation **2601.32** ft. MSL

D. Surface seal, bottom _____ ft. MSL or **3** ft.

12. USCS classification of soil near screen:

GP ☐ GM ☐ GC ☐ GW ☒ GW ☐ SP ☐
 SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
 Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☒
 Hollow Stem Auger ☐
 Other ☐

15. Drilling fluid used: Water ☒ Air ☐
 Drilling Mud ☐ None ☐

16. Drilling additives used? ☐ Yes ☐ No

Describe _____

17. Source of water:
CITY OF HAYRE MUNICIPAL

1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
 a. Inside diameter: **5' LINE, 4" SQUARE, INSIDE**
5 in.
 b. Length: **22** ft.
 c. Material: **CUT OFF (WAVE) 1/6" STEEL PIPE TO 18"** Steel ☒
 Other ☐
 d. Additional protection? ☐ Yes ☐ No
 If yes, describe: _____

3. Surface seal: Bentonite ☐
 Concrete ☒
 Other ☐

4. Material between well casing and protective pipe: Bentonite ☒
 Annular space seal ☐
 Other ☐

5. Annular space seal: a. Granular bentonite ☒
 b. _____ Lbs/gal mud weight ... Bentonite-sand slurry ☐
 c. _____ Lbs/gal mud weight ... Bentonite slurry ☐
 d. _____ % bentonite ... Bentonite cement grout ☐
 e. _____ Ft.³ volume added for any of the above
 f. How installed: Tremie ☒
 Tremie pumped ☐
 Gravity ☒

6. Bentonite seal: a. Bentonite granules ☐
 b. ☐ 1/4 in. ☐ 3/8 in. ☒ 1/2 Bentonite pellets ☒
 c. _____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
CS-1 COLORADO 20/40
 a. _____
 b. Volume added **0.1** ft.³

8. Filter pack material: Manufacturer, product name & mesh size
CS-1 COLORADO
 a. _____
 b. Volume added **1.306** ft.³

9. Well casing: Flush threaded PVC schedule 40 ☒
 Flush threaded PVC schedule 80 ☐
 Other ☐

10. Screen material: **40 PVC**
 a. Screen type: Factory cut ☒
 Continuous slot ☐
 Other ☐
 b. Manufacturer: **JOHNSON**
 c. Slot size: **0.010** in.
 d. Slotted length: **5** ft.

10. Screen material: None ☐
 Other ☐

E. Bentonite seal, top _____ ft. MSL or **51** ft.

F. Fine sand, top _____ ft. MSL or **52** ft.

G. Filter pack, top _____ ft. MSL or **53** ft.

H. Screen joint, top _____ ft. MSL or **53.5** ft.

I. Well bottom _____ ft. MSL or **58.5** ft.

J. Filter pack, bottom _____ ft. MSL or **59** ft.

K. Borehole bottom _____ ft. MSL or **59.0** ft.

L. Borehole, diameter **4.75** in.

M. O.D. well casing _____ in.

N. I.D. well casing **2** in.

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm

Bruce S. Siegmund - Assoc.

Facility/Project Name <u>UNIFIED DISTRICT DIST LIF</u>	County Name <u>BRAINE</u>	Well Name <u>mw-3</u>
Facility License Number <u>222</u>	County Code <u> </u>	MT Unique Well Number <u> </u>
		DHES Well Number <u> </u>

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method

- surged with bailer and bailed ☒
surged with bailer and pumped ☐
surged with block and bailed ☐
surged with block and pumped ☐
surged with block, bailed and pumped ☐
compressed air bailed only ☐
pumped only ☐
pumped slowly ☐
Other ☐

3. Time spent developing well 45 min.

4. Depth of well (from top of casing) 62.8 ft.

5. Inside diameter of well 2 in.

6. Volume of water in filter pack and well casing 3⁺ gal.

7. Volume of water removed from well 5 gal.

8. Volume of water added (if any) 0 gal.

9. Source of water added

10. Analysis performed on water added? ☒ Yes ☐ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. <u>43.83</u> ft.	<u>51.83</u> ft. STILL RECOVERING
Date	b. <u>04/18/93</u> mm dd yy	<u>04/18/93</u> mm dd yy
Time	c. <u>12:10</u> ☐ a.m. ☒ p.m.	<u>1:00</u> ☐ a.m. ☒ p.m.
12. Sediment in well bottom	<u> </u> inches	<u> </u> inches
13. Water clarity	Clear ☐ Turbid ☒ (Describe) <u>GREY SILT</u>	Clear ☐ Turbid ☒ (Describe) <u>GREY SILT</u>

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids 280 mg/l mg/l

15. COD mg/l mg/l

16. Additional comments on development - AFTER DEVELOPMENT:

pH = 7.70 su
T = 50.90 F
SC = 14,550 umho

Well developed by: (Person's Name and Firm)

Name: BRUCE L. SIEGMUND

Firm: DAMSCHEW + ASSOC

I hereby certify that the above information is true and correct to the best of my knowledge

Signature: Bruce L. Siegmund

Print Initials: BLS

Firm: DAMSCHEW + ASSOC

Facility/Project Name UNIFIED DISPOSAL DIST LF		Local Grid Location of Well _____ ft. ☐ N _____ ft. ☐ E _____ ft. ☐ S _____ ft. ☐ W		Well Name MW-4	
Facility License 222		Grid Origin Location Lat. _____ Long. _____ or St. Plane _____ ft. N _____ ft. S		MT Unique Well Number _____ DHES Well Name _____	
Type of Well Water Table Observation Well ☐ Piezometer ☐		Section Location of Waste/Source EYE SEC 6 T32N, R18E ☐ E ☐ W		Date Well Installed 04/17/93 m m d d y y	
Distance Well is From Waste/Source Boundary ~50' ft.		Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known		Well Installed By: (Person's Name and Firm) JOHN SHARP SHARP DRILLING BRUCE SIEGMUND, DAMSCHEW & ASSOC	
Is Well a Point of Standards Application? ☐ Yes ☐ No					

A. Protective pipe, top elevation 2611.26 ft. MSL B. Well casing, top elevation 2611.00 ft. MSL C. Land Surface elevation 2608.43 ft. MSL D. Surface seal, bottom 2645.43 ft. MSL or _____ ft.		1. Cap and lock? ☒ Yes ☐ No 2. Protective cover pipe: a. Inside diameter: 4 in. square b. Length: _____ ft. c. Material: _____ Steel ☒ d. Additional protection? ☐ Yes ☐ No If yes, describe: _____	
12. USCS classification of soil near screen: GP ☐ GM ☐ GC ☐ GW ☐ SW ☒ SP ☐ SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐ Bedrock ☐ 13. Sieve analysis attached? ☐ Yes ☒ No 14. Drilling method used: Rotary ☒ Hollow Stem Auger ☐ Other ☐ 15. Drilling fluid used: Water ☐ Air ☒ Drilling Mud ☐ None ☐ 16. Drilling additives used? ☐ Yes ☐ No Describe _____ 17. Source of water: _____		3. Surface seal: _____ Bentonite ☐ Concrete ☒ Other ☐ 4. Material between well casing and protective pipe: Bentonite ☒ Annular space seal ☐ Other ☐ 5. Annular space seal: a. Granular bentonite ☒ b. _____ Lbs/gal mud weight ... Bentonite-sand slurry ☐ c. _____ Lbs/gal mud weight ... Bentonite slurry ☐ d. _____ % bentonite ... Bentonite cement grout ☐ e. _____ Ft.³ volume added for any of the above f. How installed: _____ Tremie ☒ Tremie pumped ☐ Gravity ☒ E. Bentonite seal: a. Bentonite granules ☐ b. ☐ 1/4 in. ☐ 3/8 in. ☒ 1/2 in. Bentonite pellets ☐ c. _____ Other ☐ 7. Fine sand material: Manufacturer, product name & mesh size a. _____ b. Volume added _____ ft.³ 8. Filter pack material: Manufacturer, product name & mesh size a. CSS1 CONCRETE 20/40 b. Volume added _____ ft.³ 9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐ 10. Screen material: SCH 40 PVC a. Screen type: _____ Factory cut ☒ Continuous slot ☐ Other ☐ b. Manufacturer: JOHNSON c. Slot size: 0.010 in. d. Slotted length: 5 ft. 10. Screen material: _____ None ☐ Other ☐	
E. Bentonite seal, top _____ ft. MSL or 108 ft. F. Fine sand, top _____ ft. MSL or NA ft. G. Filter pack, top _____ ft. MSL or 109 ft. H. Screen joint, top _____ ft. MSL or 110 ft. I. Well bottom _____ ft. MSL or 115 ft. J. Filter pack, bottom _____ ft. MSL or 115.5 ft. K. Borehole bottom _____ ft. MSL or 115.5 ft. L. Borehole, diameter 4.75 in. M. O.D. well casing _____ in. N. I.D. well casing 2 in.			

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature _____ Firm _____

Bruce J. Siegmund **Damschew & Assoc.**

Facility/Project Name <u>UNIFIED DISPOSAL DIST LF</u>	County Name <u>BLAINE</u>	Well Name <u>MW-4</u>
Facility License Number <u>222</u>	County Code <u> </u>	MT Unique Well Number <u> </u> DHES Well Number <u> </u>

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method
- surged with bailer and bailed ☒
 - surged with bailer and pumped ☐
 - surged with block and bailed ☐
 - surged with block and pumped ☐
 - surged with block, bailed and pumped ☐
 - compressed air ☐
 - bailed only ☐
 - pumped only ☐
 - pumped slowly ☐
 - Other ☐

3. Time spent developing well 50 min.

4. Depth of well (from top of casing) 118.8 ft.

5. Inside diameter of well 2.0 in.

6. Volume of water in filter pack and well casing 5 gal.

7. Volume of water removed from well 5⁺ gal.

8. Volume of water added (if any) gal.

9. Source of water added

10. Analysis performed on water added? ☒ Yes ☐ No
(If yes, attach results)

Before Development	After Development
11. Depth to Water (from top of well casing) a. <u>92.25</u> ft.	<u>91.25</u> ft.
Date b. <u>04/20/93</u> mm dd yy	<u>04/20/93</u> mm dd yy
Time c. <u>9:00</u> ☒ a.m. ☐ p.m.	<u>11:00</u> ☒ a.m. ☐ p.m.
12. Sediment in well bottom <u>2</u> inches	<u> </u> inches
13. Water clarity Clear ☐ Turbid ☒ (Describe) <u>GREY SILT</u>	Clear ☐ Turbid ☒ (Describe) <u>GREY SILT</u>
14. Total suspended solids <u> </u> mg/l	<u>4</u> mg/l
15. COD <u> </u> mg/l	<u> </u> mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Additional comments on development - AFTER DEVELOPMENT

Temp = 51° F
SC = 4,600 umho
pH = 8.99 su

Well developed by: (Person's Name and Firm)

Name: BRUCE L. SIEGMUND

Firm: DAMSCHEW + ASSOC

I hereby certify that the above information is true and correct to the best of my knowledge

Signature: Bruce L. Siegmund

Print Initials: BLS

Firm: Damsczew + Assoc

Facility/Project Name <u>UNIFIED DISPOSAL DIST LF</u>		Local Grid Location of Well _____ ft. _____ ft. ☐ N ☐ S ☐ E ☐ W		Well Name <u>MW-5</u>	
Facility License <u>222</u>		Grid Origin Location Lat. _____ Long. _____ or _____		MT Unique Well Number _____ DHES Well Name _____	
Type of Well Water Table Observation Well ☐ Piezometer ☐		St. Plane _____ ft. N _____ ft. S		Date Well Installed <u>6/15/93</u> m m o d y y	
Distance Well is From Waste/Source Boundary <u>~75</u> ft.		Section Location of Waste/Source <u>E 1/2 SEC 6, T32N, R18E</u> ☐ E ☐ W		Well Installed By: (Person's Name and Firm) <u>JOHN SHARP, SHARP DRILLING</u>	
Is Well a Point of Standards Application? ☐ Yes ☐ No		Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known		<u>BRUCE SIEGMUND, DAMSCHEN + ASSOC.</u>	

A. Protective pipe, top elevation <u>2539.00</u> ft. MSL		1. Cap and lock? ☒ Yes ☐ No	
B. Well casing, top elevation <u>2538.85</u> ft. MSL		2. Protective cover pipe: a. Inside diameter: <u>4</u> in. b. Length: <u>5</u> ft. c. Material: Steel ☒ Other ☐	
C. Land Surface elevation <u>2536.62</u> ft. MSL		d. Additional protection? ☐ Yes ☐ No If yes, describe: _____	
D. Surface seal, bottom _____ ft. MSL or <u>3.0</u> ft.		3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐	
12. USCS classification of soil near screen: GP ☐ GM ☐ GC ☐ GW ☐ SP ☐ SM ☐ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐ Bedrock ☐		4. Material between well casing and protective pipe: Bentonite ☒ Annular space seal ☐ Other ☐	
13. Sieve analysis attached? ☐ Yes ☒ No		5. Annular space seal: a. Granular bentonite ☒ b. _____ lbs/gal mud weight ... Bentonite-sand slurry ☐ c. _____ lbs/gal mud weight ... Bentonite slurry ☐ d. _____ % bentonite ... Bentonite cement grout ☐ e. _____ Ft. ³ volume added for any of the above	
14. Drilling method used: Rotary ☒ Hollow Stem Auger ☐ Other ☐		f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒	
15. Drilling fluid used: Water ☐ Air ☒ Drilling Mud ☐ None ☐		6. Bentonite seal: a. Bentonite granules ☐ b. ☐ 1/4 in. ☐ 3/8 in. ☒ 1/2 in. Bentonite pellets ☒ c. _____ Other ☐	
16. Drilling additives used? ☐ Yes ☐ No Describe _____		7. Fine sand material: Manufacturer, product name & mesh size a. <u>N/A</u> b. Volume added _____ ft. ³	
17. Source of water: _____		8. Filter pack material: Manufacturer, product name & mesh size a. <u>CSSI COLORADO 20/40</u> b. Volume added <u>1 BBL</u> ft. ³	
E. Bentonite seal, top _____ ft. MSL or <u>23</u> ft.		9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐	
F. Fine sand, top _____ ft. MSL or <u>N/A</u> ft.		10. Screen material: <u>3/4" PVC</u> a. Screen type: Factory cut ☒ Continuous slot ☐ Other ☐ b. Manufacturer: <u>JOHNSON</u> c. Slot size: <u>0.010</u> in. d. Slotted length: <u>5</u> ft.	
G. Filter pack, top _____ ft. MSL or <u>24</u> ft.		10. Screen material: _____ a. Screen type: _____ b. Manufacturer: _____ c. Slot size: _____ d. Slotted length: _____	
H. Screen joint, top _____ ft. MSL or <u>24.5</u> ft.			
I. Well bottom _____ ft. MSL or <u>29.5</u> ft.			
J. Filter pack, bottom _____ ft. MSL or <u>30</u> ft.			
K. Borehole bottom _____ ft. MSL or <u>30</u> ft.			
L. Borehole, diameter _____ in.			
M. O.D. well casing _____ in.			
N. I.D. well casing _____ in.			

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Bruce S. Siegmund Firm Damschen + Assoc.

Facility/Project Name <u>UNIFIED DISPOSAL DIST LF</u>	County Name <u>BUTTE</u>	Well Name <u>MW-5</u>
Facility License Number <u>222</u>	County Code <u> </u>	MT Unique Well Number <u> </u>
		DHES Well Number <u> </u>

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method
- surged with bailer and bailed ☒
 - surged with bailer and pumped ☐
 - surged with block and bailed ☐
 - surged with block and pumped ☐
 - surged with block, bailed and pumped ☐
 - compressed air ☐
 - bailed only ☐
 - pumped only ☐
 - pumped slowly ☐
 - Other ☐

3. Time spent developing well 45 min.

4. Depth of well (from top of casing) 32.2 ft.

5. Inside diameter of well 2 in.

6. Volume of water in filter pack and well casing ~1.5 gal.

7. Volume of water removed from well 3 gal.

8. Volume of water added (if any) gal.

9. Source of water added

10. Analysis performed on water added? ☒ Yes ☐ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. <u>24.38</u> ft.	<u>23.98</u> ft.
Date	b. <u>04/18/93</u> mm dd yy	<u>04/19/93</u> mm dd yy
Time	c. <u>4:00</u> ☐ a.m. ☒ p.m.	<u>8:30</u> ☒ a.m. ☐ p.m.
12. Sediment in well bottom	<u> </u> inches	<u> </u> inches
13. Water clarity	Clear ☐ Turbid ☒ (Describe) <u>YELLOWISH -</u> <u>GREY</u>	Clear ☐ Turbid ☐ (Describe) <u>YELLOWISH -</u> <u>GREY</u>

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids <u> </u> mg/l	<u>37</u> mg/l
15. COD <u> </u> mg/l	<u>15</u> mg/l

16. Additional comments on development

pH = 7.32 su.
SC = OFF SCALE - 1/2 Dilution = 7,800 umho
T = 50.7° F
TOTAL DISSOLVED SOLIDS = 15,000 mg/l

Well developed by: (Person's Name and Firm)

Name: BRUCE SIEGMUND

Firm: DAMSCHEN + ASSOC.

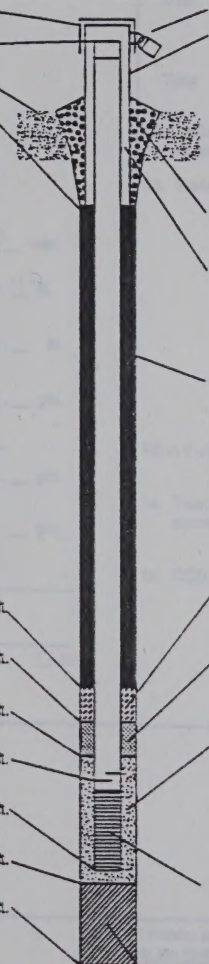
I hereby certify that the above information is true and correct to the best of my knowledge

Signature: Bruce J. Siegmund

Print Initials: BLS

Firm: DAMSCHEN + ASSOC.

Facility/Project Name <u>UNIFIED DISPOSAL DIST. LF</u>		Local Grid Location of Well _____ ft. ☐ N ☐ S _____ ft. ☐ E ☐ W		Well Name <u>MW-6</u>	
Facility License <u>222</u>		Grid Origin Location Lat. _____ Long. _____ or _____		MT Unique Well Number _____ DHES Well Name _____	
Type of Well Water Table Observation Well ☐ Piezometer ☐		St. Plane _____ ft. N _____ ft. S		Date Well Installed <u>04/18/93</u> m m o o y y	
Distance Well Is From Waste/Source Boundary <u>50</u> ft.		Section Location of Waste/Source ☐ E ☐ W		Well Installed By: (Person's Name and Firm) <u>JOHN SHARP, SHARP DRILLING</u>	
Is Well a Point of Standards Application? ☐ Yes ☐ No		Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known		<u>BRUCE SIEGMUND DAMSCHEIDT & ASSOC.</u>	

A. Protective pipe, top elevation <u>2610.09</u> ft. MSL B. Well casing, top elevation <u>2609.88</u> ft. MSL C. Land Surface elevation <u>2606.48</u> ft. MSL D. Surface seal, bottom _____ ft. MSL or <u>3</u> ft. 12. USCS classification of soil near screen: GP ☐ GM ☐ GC ☐ GW ☐ SP ☐ SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐ Bedrock ☐ 13. Sieve analysis attached? ☐ Yes ☐ No 14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Other ☐ 15. Drilling fluid used: Water ☐ Air ☐ Drilling Mud ☐ None ☐ 16. Drilling additives used? ☐ Yes ☐ No Describe _____ 17. Source of water: _____ E. Bentonite seal, top _____ ft. MSL or <u>98</u> ft. F. Fine sand, top _____ ft. MSL or <u>N/A</u> ft. G. Filter pack, top _____ ft. MSL or <u>99.0</u> ft. H. Screen joint, top _____ ft. MSL or <u>99.5</u> ft. I. Well bottom _____ ft. MSL or <u>104.5</u> ft. J. Filter pack, bottom _____ ft. MSL or <u>104.5</u> ft. K. Borehole bottom _____ ft. MSL or <u>105</u> ft. L. Borehole, diameter _____ in. M. O.D. well casing _____ in. N. I.D. well casing _____ in.	 1. Cap and lock? ☒ Yes ☐ No 2. Protective cover pipe: a. Inside diameter: <u>4</u> in. b. Length: <u>5</u> ft. c. Material: Steel ☒ Other ☐ d. Additional protection? ☐ Yes ☐ If yes, describe: _____ 3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐ 4. Material between well casing and protective pipe: Bentonite ☒ Annular space seal ☐ Other ☐ 5. Annular space seal: a. Granular bentonite ☒ b. _____ Lbs/gal mud weight ... Bentonite-sand slurry ☐ c. _____ Lbs/gal mud weight ... Bentonite slurry ☐ d. _____ % bentonite ... Bentonite cement grout ☐ e. _____ Ft.³ volume added for any of the above f. How installed: Tremie ☒ Tremie pumped ☐ Gravity ☒ 6. Bentonite seal: a. Bentonite granules ☐ b. ☐ 1/4 in. ☐ 3/8 in. ☒ 1/2 Bentonite pellets ☒ c. _____ Other ☐ 7. Fine sand material: Manufacturer, product name & mesh size a. <u>N/A</u> b. Volume added _____ ft.³ 8. Filter pack material: Manufacturer, product name & mesh size a. <u>CESI COLORADO 20/40</u> b. Volume added _____ ft.³ 9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐ 10. Screen material: <u>5" H 40 PVC</u> a. Screen type: Factory cut ☒ Continuous slot ☐ Other ☐ b. Manufacturer: <u>JOHNSON</u> c. Slot size: <u>0.010</u> in. d. Slotted length: <u>5</u> ft. 10. Screen material: None ☐ Other ☐
---	---

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Bruce J. Siegmund Firm DAMSCHEIDT & ASSOC.

Facility/Project Name <u>UNIFIED DISPOSAL INC. LF</u>	County Name <u>BUTTE</u>	Well Name <u>MW-6</u>
Facility License Number <u>222</u>	County Code <u> </u>	MT Unique Well Number <u> </u>
		DHES Well Number <u> </u>

1. Can this well be purged dry? ☐ Yes ☐ No

2. Well development method
- surged with bailer and bailed ☐
 - surged with bailer and pumped ☐
 - surged with block and bailed ☐
 - surged with block and pumped ☐
 - surged with block, bailed and pumped ☐
 - compressed air ☐
 - bailed only ☐
 - pumped only ☐
 - pumped slowly ☐
 - Other ☐

3. Time spent developing well 50 min.

4. Depth of well (from top of casing) 108.4 ft

5. Inside diameter of well 2 in.

6. Volume of water in filter pack and well casing ~3 gal. (12.15)

7. Volume of water removed from well ~5 gal.

8. Volume of water added (if any) gal.

9. Source of water added

10. Analysis performed on water added? ☒ Yes ☐ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. <u>92.25</u> ft	<u>91.25</u> ft (may still be recovering @ this time)
Date	b. <u>04/19/93</u> mm dd yy	<u>04/19/93</u> mm dd yy
Time	c. <u>11:00</u> ☒ a.m. ☐ p.m.	<u>12:00</u> ☐ a.m. ☐ p.m.
12. Sediment in well bottom	<u>1</u> inches	<u> </u> inches
13. Water clarity	Clear ☐ Turbid ☒ (Describe) <u>LIGHT GR</u>	Clear ☐ Turbid ☐ (Describe) <u>LIGHT GR</u>

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids mg/l 33 mg/l

15. COD mg/l mg/l

16. Additional comments on development:

Temp = 51.8° F
SC = 4730 umho
pH = 8.64

Well developed by: (Person's Name and Firm)

Name: BRUCE SIEGMUND

Firm: DAMSCHEN + ASSOC.

I hereby certify that the above information is true and correct to the best of my knowledge

Signature: Bruce I. Siegmund

Print Initials: BLS

Firm: Damschen + Assoc.

Underground Tanks ☐ Other ☐

Facility/Project Name UNIFIED DISPOSAL DISTRICT	Local Grid Location of Well _____ ft. ☐ E ☐ W ☐ N ☐ S	Well Name MTW - 7
Facility License 222	Grid Origin Location Lat. _____ Long. _____ or _____	MT Unique Well Number: _____ DHES Well Name _____
Type of Well Water Table Observation Well ☐ Piezometer ☐	St. Plane _____ ft. N _____ ft. S	Date Well Installed 04/15/93 m m d d y y
Distance Well is From Waste/Source Boundary 25 ft.	Section Location of Waste/Source E 1/2 SEC 6, T32N, R18E ☐ E ☐ W	Well Installed By: (Person's Name and Firm) JOHN SHARP, SHARP DRILLING
Is Well a Point of Standards Application? ☐ Yes ☐ No	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☒ Not Known	BRUCE SIEGMUND, DAMSCHEW & ASSOC.

A. Protective pipe, top elevation 2605.88 ft. MSL	1. Cap and lock? ☒ Yes ☐ No
B. Well casing, top elevation 2605.71 ft. MSL	2. Protective cover pipe: a. Inside diameter: 4 in. b. Length: 5 ft. c. Material: ☒ Steel ☐ Other ☐
C. Land Surface elevation 2601.5 ft. MSL	d. Additional protection? ☐ Yes ☐ No If yes, describe: _____
D. Surface seal, bottom 2 ft. MSL or 30 ft.	3. Surface seal: ☐ Bentonite ☒ Concrete ☐ Other ☐
12. USCS classification of soil near screen: GP ☐ GM ☐ GC ☐ GW ☒ SW ☐ SP ☐ SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐ Bedrock ☐	4. Material between well casing and protective pipe: ☐ Bentonite ☐ Annular space seal ☐ Other ☐
13. Sieve analysis attached? ☐ Yes ☒ No	5. Annular space seal: a. Granular bentonite ☒ b. _____ Lbs/gal mud weight ... Bentonite-sand slurry ☐ c. _____ Lbs/gal mud weight ... Bentonite slurry ☐ d. _____ % bentonite ... Bentonite cement grout ☐ e. _____ Ft. ³ volume added for any of the above
14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Other ☐	f. How installed: Tremie ☒ Tremie pumped ☐ Gravity ☒
15. Drilling fluid used: Water ☒ Air ☒ Drilling Mud ☐ None ☐ INJECTED WATER @ 11'	6. Bentonite seal: a. Bentonite granules ☐ b. ☐ 1/4 in. ☐ 3/8 in. ☒ 1/2 in. Bentonite pellets ☒ c. _____ Other ☐
16. Drilling additives used? ☐ Yes ☒ No	7. Fine sand material: Manufacturer, product name & mesh size a. CSSI COLORADO 20/40 b. Volume added 0.1 ft. ³
Describe _____	8. Filter pack material: Manufacturer, product name & mesh size a. CSSI COLORADO b. Volume added 6 BAGS ft. ³
17. Source of water: CITY OF HAILE (Municipal)	9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
E. Bentonite seal, top _____ ft. MSL or 9 ft.	10. Screen material: FLUSH THREADED PVC SCH 40 a. Screen type: Factory cut ☒ Continuous slot ☐ Other ☐
F. Fine sand, top _____ ft. MSL or 10 ft.	b. Manufacturer: JOHN SHARP c. Slot size: 0.026 in. d. Slotted length: 5 ft.
G. Filter pack, top _____ ft. MSL or 11 ft.	10. Screen material: ☐ None ☐ Other ☐
H. Screen joint, top _____ ft. MSL or 11 ft.	
I. Well bottom _____ ft. MSL or 16 ft.	
J. Filter pack, bottom _____ ft. MSL or 16 ft.	
K. Borehole bottom _____ ft. MSL or 17 ft.	
L. Borehole, diameter 4.75 in.	
M. O.D. well casing _____ in.	
N. I.D. well casing 2.0 in.	

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature _____ Firm _____

Bruce S. Siegmund DAMSCHEW & ASSOC.

Facility/Project Name <u>UNIFIED DISPOSAL DIST LF</u>	County Name <u>BLAINE</u>	Well Name <u>m-7</u>
Facility License Number <u>222</u>	County Code <u> </u>	MT Unique Well Number <u> </u> DHES Well Number <u> </u>

1. Can this well be purged dry? ☐ Yes ☐ No

2. Well development method
- surged with bailer and bailed ☐
 - surged with bailer and pumped ☐
 - surged with block and bailed ☐
 - surged with block and pumped ☐
 - surged with block, bailed and pumped ☐
 - compressed air ☐
 - bailed only ☐
 - pumped only ☐
 - pumped slowly ☐
 - Other ☐

3. Time spent developing well min.

4. Depth of well (from top of casing) ft.

5. Inside diameter of well in.

6. Volume of water in filter pack and well casing gal.

7. Volume of water removed from well gal.

8. Volume of water added (if any) gal.

9. Source of water added

10. Analysis performed on water added? ☐ Yes ☐ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. <u> </u> ft.	<u> </u> ft.
Date	b. <u> </u> / <u> </u> / <u> </u> mm dd yy	<u> </u> / <u> </u> / <u> </u> mm dd yy
Time	c. <u> </u> : <u> </u> ☐ a.m. ☐ p.m.	<u> </u> : <u> </u> ☐ a.m. ☐ p.m.
12. Sediment in well bottom	<u> </u> inches	<u> </u> inches
13. Water clarity	Clear ☐ Turbid ☐ (Describe) <u> </u>	Clear ☐ Turbid ☐ (Describe) <u> </u>

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids mg/l mg/l

15. COD mg/l mg/l

16. Additional comments on development:

WELL HAD NO SIGNIFICANT WATER - PURGED DRY w/ NO RECOVERY.
GRAVEL MOST LIKELY CAVED TO TOP OF WATER LEVEL
DURING INSTALLATION

Well developed by: (Person's Name and Firm)

Name: BRUCE SIEGMUND

Firm: DANSEN + ASSOC.

I hereby certify that the above information is true and correct to the best of my knowledge

Signature: Bruce Siegmund

Print Initials: BS

Firm: Dansen + Assoc.

IV. APPENDICES

Appendix A. Well logs of monitoring wells at the Unified Disposal District landfill east of Havre, Montana.

Appendix B. Field personnel equipment checklist, operating procedures and field data sheets.

Project Name/Location: _____

A. MATERIALS

- _____ 5 ml vials to be sampled
- _____ 5 ml syringes
- _____ 5 ml double-ended syringes
- _____ Tins
- _____ Hand-grip 3
- _____ Sample containers and bottles wherever specified by the laboratory
 - a. 2 100-ml glass vials
 - b. 2 100-ml plastic bottles
 - c. 2 100-ml plastic bottles
- _____ Preservatives (for Energy Lab, College, MT)
 - a. HNO₃ (nitric acid) in 250-ml bottle with RED cap
 - b. H₂SO₄ (sulfuric acid) in 250-ml bottle with YELLOW cap
 - c. H₂O₂ (hydrogen peroxide) in 250-ml bottle with GREEN cap
 - d. HCl (hydrochloric acid) in two glass vials
- _____ High-pressure detergent
- _____ Decontamination detergent water spray
- _____ Laundry detergent
- _____ Decontamination spray 2.5 gal per well treatment
- _____ 2 buckets of borate solution, polypropylene 5 gal
- _____ Chlorine bleach
- _____ Well probe (attach water and mud if in hole)
 - a. when it is necessary has not been used on this project prior to the current well
- _____ Water Analysis kit, conductivity and resistivity
 - a. calibration buffer (attach water, resistivity)
 - b. and verification procedures to field data sheets if instrument has not been used on this project prior to the current date
- _____ Extra film (vials)
- _____ Disposable gloves
- _____ Disposable towels
- _____ New battery (syringe)
- _____ Hand-dish soap
- _____ Ice
- _____ Sleeping bags
- _____ Sleeping bags
- _____ Well sampling data sheets

MONITORING WELL SAMPLING PROCEDURE

Project Name/Number _____

A. MATERIALS

- _____ # of wells to be samples
- _____ # of duplicates
- _____ # of field/rinse blanks
- _____ Total
- _____ Total plus 2

- _____ Sample container sets (unless otherwise specified by the laboratory:
 - a. 2 40-ml glass vials
 - b. 3 250-ml plastic bottles
 - c. 1 500-ml plastic bottle

- _____ Preservatives (for Energy Labs, Billings, MT, 1992):
 - a. HNO_3 (nitric-put in 250-ml bottle with **RED** top)
 - b. H_2SO_4 (sulfuric-put in 250-ml bottle with **YELLOW** top)
 - c. NaOH (sodium hydroxide-put in 250-ml bottle with **GREEN** top)
 - d. HCl (hydrochloric-put in two glass vials)

- _____ Non-phosphate detergent
- _____ Decontamination deionized water rinse
- _____ Garden sprayer
- _____ Deionized water, 0.5 gallon per well minimum
- _____ 2 buckets of known volume, preferably 5 gallon
- _____ Glass-lined Thermos
- _____ Well probe (attach name and model # to field sheets if instrument has not been used on this project prior to the current date)
- _____ Water Analyzer (pH, conductivity and temp) and calibration buffers (attach name, model number, and calibration procedures to field data sheets if instrument has not been used on this project prior to the current date)

- _____ Extra foot valves
- _____ Disposable gloves
- _____ Disposable bailers
- _____ New bailer rope
- _____ Hard-shelled cooler(s)
- _____ Ice
- _____ Shipping labels
- _____ Strapping tape
- _____ Well sampling data sheets

B. PROCEDURE

1. Zero the pH/temp/conductivity meter.
2. Measure the depth to water. Try to measure it to within 0.05 feet (within ≈ 0.5 inches). Rinse probe tip with detergent and water, rinse with deionized water.
3. Measure the depth to the bottom of the well, if not known.
4. Purge the well. Calculate the amount of water to be removed from the well. A two-inch-diameter well contains 0.16 gallons per linear foot. A four-inch-diameter well contains 0.653 gallons per linear foot. If there are no instructions attached to the well, or if other purging information is not available, purge three volumes. If the well is bailed or pumped dry by this effort, return after a couple of hours and sample without purging (fresh water has entered the well at that point).
5. Take the well's temperature and pH--rinse thermos with well water, fill and put the temperature/pH probe in. Wait until it equilibrates, measure parameters.
6. Take the samples. Lay out the sample containers and the preservatives (see above). Take one sample at a time, adding the preservative **after** the sample container is filled. Take the VOC samples first, leaving no headspace. Fill the sample containers to the top, trying not to leave any airspace. **PUT ALL SAMPLES IN THE COOLER IMMEDIATELY!! KEEP THEM UPRIGHT.**
7. Check the paperwork.
8. Re-cap the well securely and lock it.
9. Thoroughly decontaminate the instruments with non-phosphate detergent and rinse with deionized water.

C. SAMPLE STORAGE AND SHIPMENT

1. Samples should be stored in a chilled cooler and kept in a cool, secure place.
2. The samples must be shipped expeditiously, no more than 48 hours after collection. They should be sent to the lab via UPS or bus as soon as possible after collection. **BE SURE TO INCLUDE A SAMPLE "CHAIN OF CUSTODY" FORM THAT IS FULLY COMPLETED AND SIGNED. MAKE A COPY.**

DAMSCHEEN & ASSOCIATES, INC.

Landfill Monitoring Well Sample Report

Project Name/Number _____ Well Number _____

Date/Time _____ Conditions _____

Field Data:

Depth to Water _____ Total Depth _____

Volume of Water Purged _____

(Data below should be an average of three readings)

Temperature--#1 _____ --#2 _____ --#3 _____ --Mean _____

Conductivity--#1 _____ --#2 _____ --#3 _____ --Mean _____

pH--#1 _____ --#2 _____ --#3 _____ --Mean _____

Check off; if not taken, make note in Comments section:

250 ml w/ H_2SO_4 (yellow) _____

250 ml w/ HNO_3 (red), filtered _____

250 ml w/ NaOH (green) _____

500 ml w/ no preservative _____

40 ml, 2, w/ HCl (blue) _____

Comments (attach instrumentation information to this sheet if necessary):

Appendix C. Field equipment operation and calibration information.

Figure 2. Topographic map of the Unified Disposal District landfill east of Havre, Montana, showing approximate waste fill area and monitoring well locations.

- Digital display liquid-crystal type, 3 1/2 digit
- Visual warning when battery needs to be replaced
- 9 Volt Alkaline Battery
- Automatic battery strength compensation
- Rugged ABS (Acrylonitrile Butadiene Styrene) instrument case plus handy carrying case



Conductance measurement	Temperature measurement	pH measurement	ACCURACY
A range, expanded in increments 0 to 20 0 to 200 0 to 2,000 0 to 20,000 Integral sample cup Available Cellbrite Adjustment	0 to 140° Fahrenheit range Integral sample cup	0 to 14 range Slope and zero adjustments on line of unit External electrode Buffer solutions available	Conductivity $\pm 2\%$ Full Scale Temperature $\pm 3^\circ$ Fahrenheit pH $\pm .01$ pH units at 27° Fahrenheit

FEATURES

- Minimize laborious procedures to determine the strength of cleaning solutions
- Detect the presence of early onset or other contaminants in steam condensate (conductance measurement)
- Allow monitor the effectiveness of ammonia return line chemical treatment (pH measurement)
- Integral sample cup eliminates external probe for conductance and temperature measurements
- Multiple range selection improves versatility
- Quick determination of Dissolved Solids concentration and pH in Cooling Tower and Boiler water
- Covers the full range of conductance and pH without the need of an external
- External pH electrode provides routine measurement of electrode

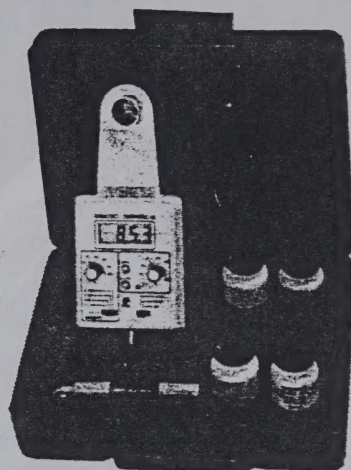
ORDERING INFORMATION

Control Weight
37 gram
1.31 oz. net
Dimensions
3 1/2" x 2 1/4" x 1 1/2"

Conductivity/Temperature/Temp. COMPENSATION, RANGE, RANGE, RANGE	Rating for 10000
Conductivity/Temperature/Temp. COMPENSATION, RANGE, RANGE, RANGE	Rating for 10000
Conductivity/Temperature/Temp. COMPENSATION, RANGE, RANGE, RANGE	Rating for 10000
Conductivity/Temperature/Temp. COMPENSATION, RANGE, RANGE, RANGE	Rating for 10000
Conductivity/Temperature/Temp. COMPENSATION, RANGE, RANGE, RANGE	Rating for 10000
Conductivity/Temperature/Temp. COMPENSATION, RANGE, RANGE, RANGE	Rating for 10000

FEATURES

- Digital display liquid-crystal type, 3-½ digit
- Visual warning when battery needs to be replaced
- 9 Volt Alkaline Battery
- Automatic battery strength compensation
- Rugged ABS (Acrylonitrile Butadiene Styrene) instrument case plus handy carrying case



Conductance measurement

4 ranges, measured in micromhos

0 to 20

0 to 200

0 to 2,000

0 to 20,000

Integral sample cup

Accessible Calibration Adjustment

Temperature measurement

0 to 160° Fahrenheit range

Integral sample cup

pH measurement

0 to 14 range

Slope and zero adjustments on face of unit

External electrode

Buffer solutions available

ACCURACY

Conductivity $\pm 2\%$ Full Scale

Temperature $\pm 2^\circ$ Fahrenheit

pH $\pm .01$ pH units of 77° Fahrenheit

BENEFITS

- Eliminates titration procedures to determine the strength of cleaning solutions
- Detects the presence of carry-over or other contaminants in steam condensate (conductance measurement). Also monitors the effectiveness of condensate return line chemical treatment (pH measurement)
- Integral sample cup eliminates external probe for conductance and temperature measurement
- Multiple range selection improves resolution
- Quick determination of Dissolved Solids concentration and pH in Cooling Tower and Boiler water
- Covers the full range of conductance and pH without the need of an adapter
- External pH electrode enables routine replacement of electrode

ORDERING INFORMATION

(Controller Weight:

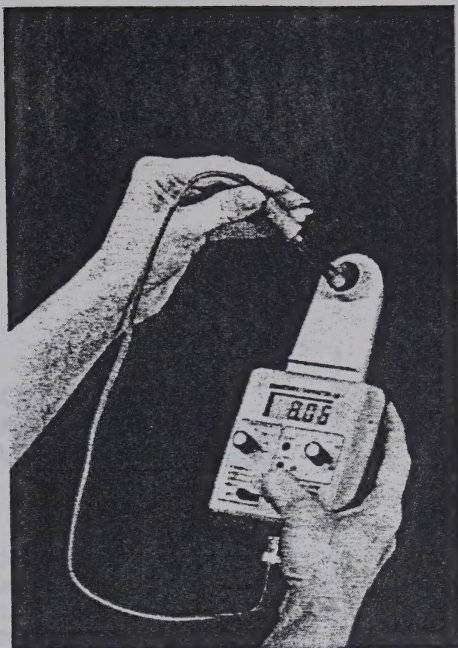
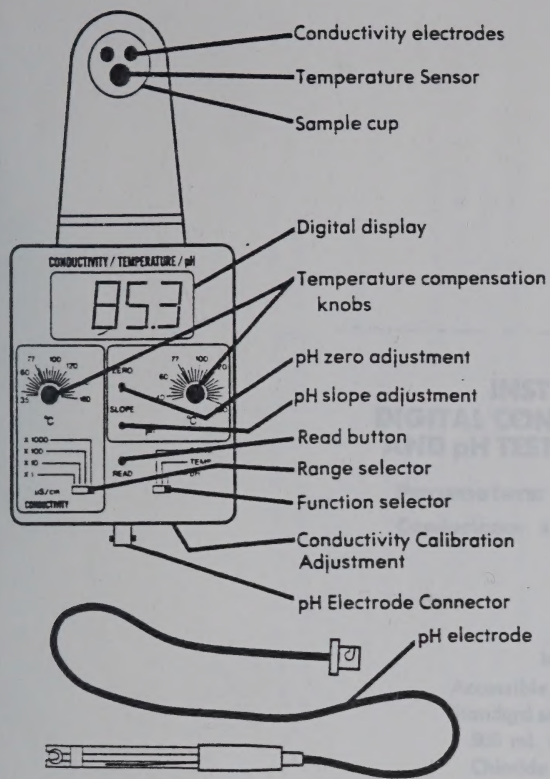
3# gross

1# 12 oz. net

Dimensions:

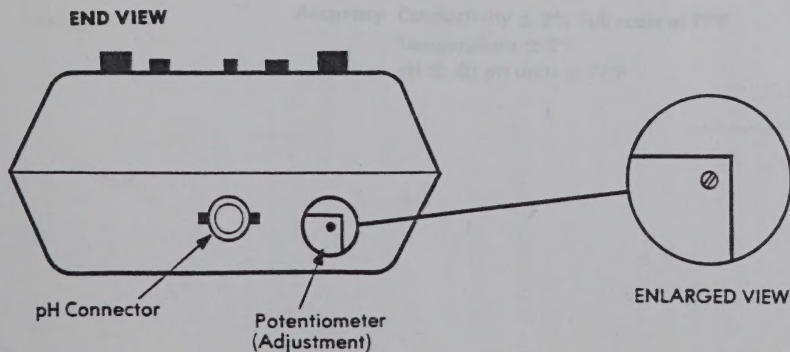
11"Lx8-1/2"Wx4"H)

Conductivity/Temperature/pH Tester COMPLETE incl. 301353, 850136, 850137	Catalog No. 910129
Conductivity/Temperature/pH Tester, includes case only	Catalog No. 301353
pH electrode only	Catalog No. 850136
Buffer Solution Kit includes buffer solution 4, 7 and 10 pH and bottle of (distilled) water for rinse only	028307 Catalog No. 850137
500 ml. Bottle Standard Conductance Solution only (.01 Molar Potassium Chloride), 1413 micromhos	031937 Catalog No. 905770



TESTER IN USE (Measuring pH)

CONDUCTIVITY CALIBRATION



(Note-Hole is normally covered by a black plug)

For additional information, request a copy of our publication HI 831-1.

INSTRUCTION MANUAL DIGITAL CONDUCTANCE, TEMPERATURE AND pH TESTER, CATALOG No. 301353

Parameters:

Conductance 4 ranges

0 to 20 μ /cm

0 to 200 μ /cm

0 to 2,000 μ /cm

0 to 20,000 μ /cm

Integral sample cup

Accessible internal calibration potentiometer

Standard solution available:

500 ml. Bottle of .01 Molar Potassium

Chloride 1413 micromhos @ 77°F.

pH 0 to 14 range

Slope and zero adjustments on face of unit

External electrode (purchased separately)

Buffer solution kit available, includes:

Buffer solutions, 4, 7 and 10 pH

Bottle of (distilled) water for rinse

Temperature 0 to 160°F

Integral sample cup

Accuracy Conductivity $\pm 2\%$ Full scale at 77°F

Temperature $\pm 2^\circ\text{F}$

pH $\pm .01$ pH units at 77°F

Operating Instructions:

1. Rinse the inside of sample cup with liquid to be measured. (This is especially important if samples with a wide range of conductivity or pH are to be measured.)
2. Fill sample cup. (see Figure 1).

CAUTION: THE MAIN BODY IS NOT WATER-PROOF
(Do not subject unit to splashing water).

CAUTION: UNIT DESIGNED FOR AQUEOUS SOLUTIONS
ONLY!

3. Fill sample cup at least 2/3 full. If the sample is hot boiler water, allow to cool to 160°F, or below.
4. Slide the right hand function switch to "TEMP" and push the "READ" button. If temperature reading is not stable, empty & refill cup several times to bring cup and sample to the same temperature.
5. Read the temperature on the digital display panel and adjust both temperature compensation knobs accordingly.
6. If the approximate conductance is known, slide the left hand range selector switch to the proper range.

Example: If you expect the sample to be around 2000 micromhos, slide the left hand selector switch to x1000.

7. Slide the right hand function switch to "COND" and push the "READ" button.

8. Multiply the digital display reading by the factor indicated by the position of the left hand range switch to determine conductance.

Example: A display reading of 1.00 with the left hand range selector switch indicating x1000 is:

$$1.00 \times 1000 \text{ or } 1000 \mu / \text{cm}$$

Note: If a single "1" appears on the left hand side of the digital display, the sample conductance is higher than the selected range. Slide the left hand (range) selector switch in one step intervals until a 3 or 4 digit display appears.

Conversely, if a decimal display appears (such as 0.11) move the range selector switch to the left until a 3 or 4 digit number, 1.00 or larger, appears on the display. This puts the unit in a range affording the best accuracy. Caution: A single "1" always means that the conductance is higher than the selected range.

9. Slide the right hand function selector switch to "pH".
10. Insert the pH cable connector onto the tester. Push on and twist clockwise.
11. Remove the tape from the plastic storage cap.
12. Remove the plastic storage cap slowly.
13. Place the pH electrode in the sample cup or any non-metallic container holding the remainder of the sample to be measured. If you use the tester's sample cup, you will have to hold the electrode.

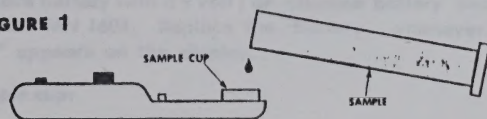
14. Press the "READ" button: pH value will appear on the digital display.

15. Always obtain conductivity reading before placing pH probe in sample cup. pH probes tend to carry contamination over into the sample.

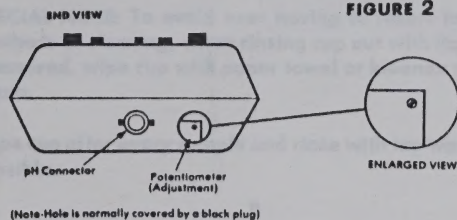
CAUTION:

The main body is not waterproof.

FIGURE 1



CONDUCTIVITY CALIBRATION



CALIBRATION

Temperature and Conductance are factory calibrated. You may check conductance accuracy with a solution of known conductance and recalibrate, if necessary.

See Figure 2. To recalibrate conductance, remove black plug revealing the adjustment potentiometer screw. Add standard solution to cup, discard and refill. Repeat procedure until the digital display indicates the same value twice in a row. Adjust the potentiometer until the digital display indicates the known value of conductance. To increase the digital display reading, turn the adjustment potentiometer screw counterclockwise (clockwise to decrease).

To standardize the pH electrode and meter, place the pH electrode in the 7.0 buffer bottle. Adjust the "ZERO" potentiometer on the face of the tester so that the digital display indicates 7.00.

Then place the pH electrode in the 4.0 or 10.0 buffer bottle (depending on where you expect the actual measurement to be). Adjust the "SLOPE" potentiometer on the face of the tester so that the digital display indicates the value of the buffer chosen.

NOTE: There is interaction between the "ZERO" and "SLOPE" adjustments, so the procedure should be repeated several times.

DO NOT SUBJECT THE pH ELECTRODE TO FREEZING TEMPERATURES!

It is good practice to rinse the electrode in distilled water when going from one buffer to another. When not in use the cap should be kept on the electrode. Keeping the cotton in the cap moist will keep the electrode ready to use. Moisten the cotton frequently (once a week, usually).

Maintenance

Battery replacement

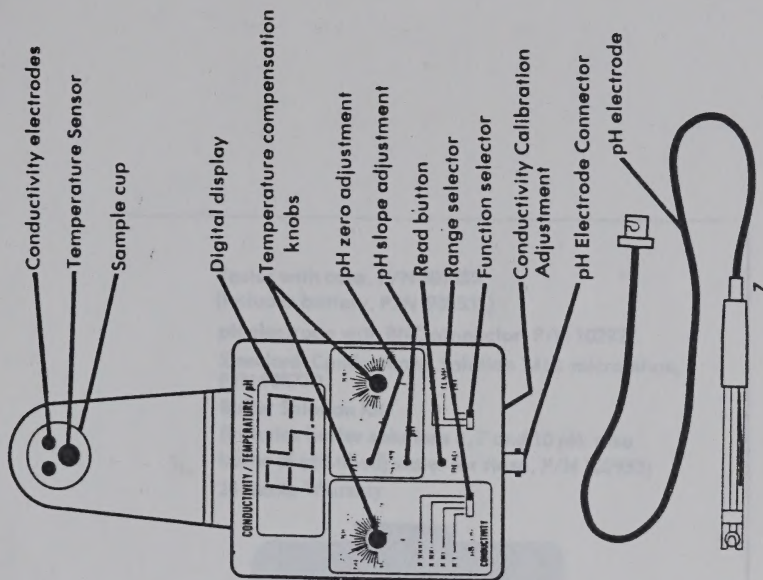
The battery is located behind the snap-off cover on the bottom of the tester. Use a small tool to pop out the cover. Replace battery with a 9 volt ; an alkaline battery such as Duracell MN 1604. Replace the battery whenever "LO BAT" appears on the display.

Sample cup:

The carbon electrodes in the cup may be cleaned with a mild abrasive, 400 grit or finer on the end of the flat surface.

SPECIAL NOTE: To avoid ever having to resort to harsher methods of cleaning, when rinsing cup out with liquid to be measured, wipe cup with paper towel or kleenex and rinse again.

Wipe cup after every sample and rinse with tap water when possible.



Tester with case, P/N 301353
(includes battery, P/N 905531)

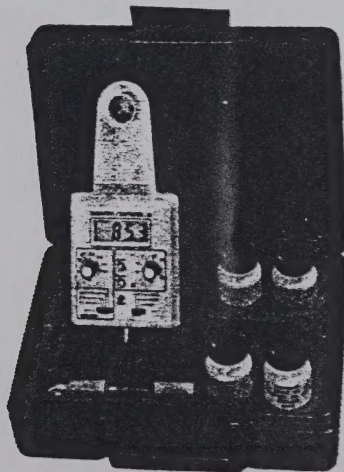
pH electrode with BNC connector, P/N 102927

Standard Conductance Solution 1413 micromhos,
P/N 905770

Buffer Solution Kit

(includes buffer solutions 4, 7 and 10 pH; also
bottle of (distilled) water for rinse, P/N 102953)

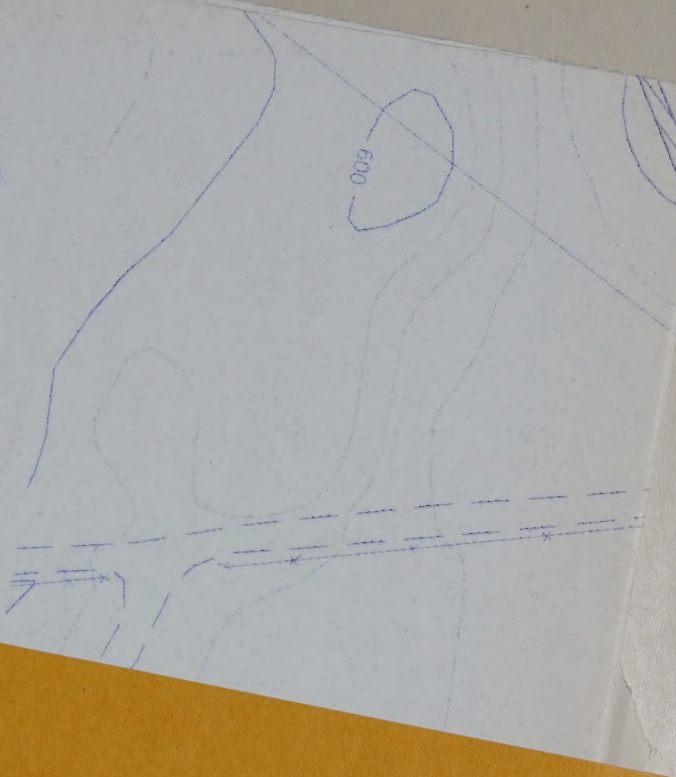
24 Month Warranty

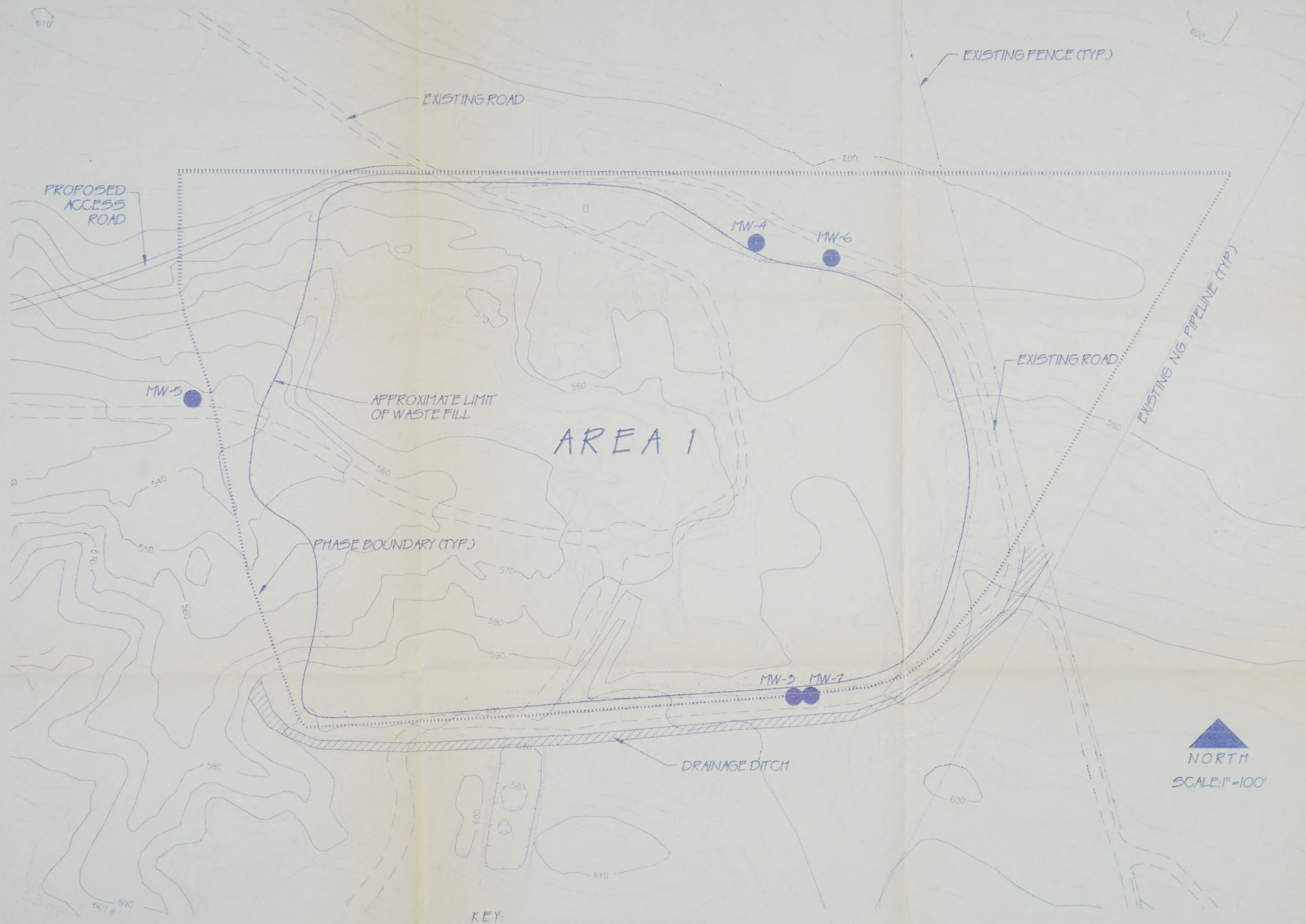


HI831-I-3

CSI CAMBRIDGE SCIENTIFIC INDUSTRIES
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Figure 2. Topographic map of the
East of Havre, Montana, 3
boundaries and monitoring





KEY:

— APPROXIMATE LIMIT OF WASTE FILL

● MONITORING WELL LOCATION

CONTOUR INTERVAL = 2'

Figure 2. Topographic map of the Unified Disposal District landfill East of Havre, Montana, showing approximate waste fill boundaries and monitoring well location.



32K-94W
9 1/4 X 14 1/2

